

THE EFFECT OF PROFESSIONAL DEVELOPMENT TRAINING
FOR SECONDARY MATHEMATICS TEACHERS
CONCERNING NONTRADITIONAL
EMPLOYMENT ROLES
FOR FEMALES

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This quasi-experimental study, utilizing quantitative and qualitative descriptive methods, examined the sex-egalitarian attitudes of secondary mathematics teachers from the Ft. Worth Independent School District. A video tape, *Women in the Workplace*, was used as a training intervention to test the effectiveness of professional development training in altering the mathematics teachers' sex-egalitarian attitudes towards female employment. Information on the video presented seven jobs that provide opportunities for female students in the science, engineering, and technology fields that are considered nontraditional jobs for females.

Subjects completed 19 Employment Role domain questions on the King and King (1993) Sex-Role Egalitarianism Scale. A one-way ANOVA was applied to the data to test for a significant difference in the means of the control group, who did not see the video, and the experimental group that viewed the video.

Findings concluded that there was no significant difference in the sex equalitarian mean scores of the control group and the experimental group. The research indicated that it takes an intensive and prolonged training period to produce a significant change in people's attitudes. This study supports the research on length of training needed to change sex egalitarian attitudes of classroom teachers.

There were data collected on four demographic areas that included gender, age, ethnicity, and years of teaching experience. A two-way ANOVA was applied to four demographic variables to test for interaction and main effect. A significant difference was found between the sex-egalitarian attitudes of male and female mathematics teachers' responses. There were no significant differences found in the sex egalitarian attitudes of secondary mathematics teachers when categorized by levels of age, ethnicity, and years of teaching experience. The information in this study should interest and benefit teachers, parents, students, administrators, and industry leaders.

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CHAPTER 1

INTRODUCTION

There has been a paradigm shift in gender roles over the last few years, and society continues to experience a change in traditional female-male role attitudes. Visionary leaders are demanding a move toward gender equity in the employment and education roles of females (King & King, 1993). Gender bias is seen as a negative in educational and workplace settings, and new methods of interventions in schools are being tried to produce a more nontraditional mindset among students and educators. Concerned educators strive to produce a gender equitable school, which has become especially important in high school science, mathematics, and technology classes because of the disparity in employment between males and females in the science, engineering, and technology (SET) fields.

This research study addresses an important element of gender bias by measuring secondary mathematics teachers' sex-role egalitarian attitudes in the employment roles domain. Because secondary mathematics teachers are in a position to influence students' career choices requiring a background in mathematics, receiving gender equity training is important to assure that these teachers have gender equitable attitudes about females performing nontraditional jobs. A nontraditional gender equity attitude for secondary mathematics teachers will encourage females to follow career paths that may lead to employment in the SET fields.

Society considers the SET fields to be traditional male domains (Bailey & Stadt, 1973, p. 113). However, it is important that more females enter the SET fields in the 21st century in greater numbers than they are doing today, in order to fill the explosion of future jobs that will require mathematics backgrounds (Huang, Taddese, & Walter, 2000). Therefore, this study should provide valuable information about gender equity and gender bias to mathematics teachers, parents, students, administrators, government leaders, and the business community.

Background

The social reality today is that people in the United States expect more equity in educational and career opportunities for women (Gitterman, Levi, & Ziegler, 1993). According to the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology (CCAWMSETD, 2000), there is a need to increase female employment in the SET fields. A 35% disparity exists between male and female employment (CCAWMSETD, 2000). The 15% employment of women in the SET fields in 1986 (National Science Foundation [NSF], 1997) had risen to only 22% by 1993 and had remained at 22% through 1997. During that same time, the overall female employment rate had risen to over 46% of the total workforce (Bureau of Labor Statistics [BLS], 1998). Females have made extraordinary employment gains in many career fields and now make up over half of the college student enrollment (Mortenson, 1999, p. 8). Although females receive over half of the undergraduate degrees, they are still underrepresented in undergraduate engineering, science, and technology programs, with only about 15% of these degrees going to females (Huang et al., 2000, p. 81).

A prerequisite for careers in the SET fields is mathematics training. If females do not make the SET career decisions in their high school years, they may not enroll in higher mathematics courses, which are required to prepare for careers in the SET fields. It is essential that the United States use both its male and female resources to meet the future demand for professionals with mathematics backgrounds in order to remain competitive in the global market (CCAWMSETD, 2000). Bailey and Stadt (1973, p. 135), referred to womanpower as one of the nation's greatest resources. Females generally bring a creative attitude to the workplace and males usually have a more practical how to approach. When males and females cooperate on tasks, they can be more productive than single gender groups. In order to solve this critical employment problem, educators must actively encourage females and minorities to choose technical careers that are presently being filled mostly with white males and male immigrants (Huang, 2000, p. 1).

Significance of the Study

Traditionally, fewer females than males follow a mathematics career path, and thus females are underrepresented in careers that require mathematics training. The National Science Foundation (1997) reported the following:

1. Women constituted over 50% of the nation's workforce.
2. 22% of employed scientists and engineers were female.
3. 24% of employed mathematicians were female.
4. By the year 2000, the need for employees in quantitative fields will be 36% higher.

5. The traditional pool of white males, which supplies most scientists and engineers, will shrink to 15% of the new entrants into the workforce. (p. 4)

Today the predictions of the NSF (1997) are being confirmed, and educators and the business community are making an effort to encourage students to follow careers in mathematics and science. These careers can provide higher-paying technical jobs with prestige. As professionals, women in the SET field have an opportunity to earn more money and move to an equal employment status with men. The National Council of Teachers of Mathematics (NCTM), in 1997, called for a national effort to encourage all sectors of the population to consider careers in mathematics and science. The school setting is in the unique position of assisting students in all types of career choices, but the agenda of the educational community has not been clear as to how schools should recruit and prepare students for specific careers.

The patchwork of career guidance programs such as transition-to-work, technological education, employability skills, and cooperative education are important, but they do not adequately address the career development needs of the students. (Gitterman et.al., 1995, p.1) Teachers of mathematics are in an excellent position to encourage and inform their students of the opportunities in career fields requiring a mathematics background. Mathematics teachers holding traditional attitudes about female and male employment, however, can produce a negative effect on females. These teachers can unwittingly lower their female students' self-concept and confidence about their ability to do mathematics (Sadker & Sadker, 1994). Females who might be thinking

about a career in the SET fields could be receiving less encouragement and attention from their mathematics teachers than males. According to Sadker and Sadker,

If teachers ignore passive females and recognize outspoken males, the result is that girls receive less time, less help, and fewer challenges. Reinforced for passivity, their independence and self-esteem suffer. As victims of benign neglect, girls are penalized for doing what they should and lose ground as they go through school. In contrast, boys are reinforced for breaking the rules; they are rewarded for grabbing more than their fair share of the teacher's time and attention. (p.44)

Theoretical Framework

The theoretical framework for this study is gender bias as it relates to sex-role attitudes toward women in the workplace. The disparity in employment of males and females in the science, engineering, and technology fields appears to be the result of gender bias at some level of the preparation and employment pipeline.

Mathematics teachers may unwittingly give more attention to males because a higher percentage of males enter careers requiring a strong mathematics background, and they feel that males will be more likely to use mathematics training in future career paths (Huang et al., 2000). Mathematics teachers who treat their female students in such an unfair manner may be doing so unconsciously and with no real malice (Scott, 2000, p. 80). Mathematics teachers may only be expressing their traditional attitudes about traditional male and female career roles in the workforce. Teachers may not realize that

the attitudes they portray may affect their female students in a negative way (Sadker & Sadker, 1994, p.44).

There have been many vocal critics, usually from the women's rights movement that started in the 1960s, about gender bias in the educational system. The women's rights movement should receive a great deal of credit for the gains women have made in acquiring equal rights with males in the educational system and in the workplace. As a result of their efforts, educators and society in general have become concerned about the equitable treatment of males and females in the classroom (Houston, 1996, p.75; Scott, 2000).

In the early 1950s, Donald Super developed a career guidance self-concept theory on the assumption that career education is developmental (Bailey & Stadt, 1973, p. 69). He believed that career guidance should be a part of the total school curriculum in addition to stand-alone career exploration classes. Career education should encourage students to see the relevance of school subjects (Gitterman et al., 1993). Contextual learning emphasizes the acquisition of knowledge with intent to use the material presented in a life or employment situation. Material learned in this manner is remembered longer and elicits more attention and involvement from the student (Balas, A., 1997). It is evident that contextual learning occurs when students make early decisions concerning what careers they want to follow. If a student is relatively sure about his or her future career choice, this realization adds more impetus and importance to related subjects. One possible area of inequitable treatment of girls involves the traditional perception of society that boys will choose careers in engineering, science,

and technology (Bailey & Stadt, 1973, p. 113). By the 10th grade, the percentage of boys who believe that they will do well in mathematics is 7% higher than that of girls, which may be one reason why boys sign up for more advanced mathematics classes in high school (Huang et al., 2000, p.44).

Males and females perform and participate equally in mathematics prior to adolescence. Girls then begin to exhibit less confidence and success in their mathematical ability (Huang et al., 2000, p. 44). In high school, when the choice of mathematics (Algebra II and higher) becomes optional, males are more likely to choose mathematics than females, and the performance of males is better, even though it is a small difference (Linn & Hyde, 1989). Sadker and Sadker (1994) stressed that gender bias is rampant in the classroom. To demonstrate how teachers were discriminating against girls, they conducted a research project using six schools in the Northeast as research subjects. They placed observers in the classrooms to document the number of times teachers called on males and females. Their research found that teachers do call on males more than females. Some of the extra attention was due to preference, and some was due to the misbehavior of the boys. Regardless of the reasons for more attention, the females end up at a disadvantage for teacher attention.

The stereotyping of careers for females by teachers and parents seems to affect girls' perceptions of mathematics in future career decisions. According to Eccles, parents have lower expectations for daughters than sons, attributing a daughter's success in mathematics and science more to effort than ability. Boys' success in mathematics

appears to be attributed more to ability than to effort (as cited in Chipman, Brush, & Wilson, 1985).

Fennema and Leder (1990) pointed out that counselors' and teachers' perceptions and beliefs could affect students' career goals and their selection of advanced mathematics or science courses. They also suggested that stereotypes and traditional attitudes about quantitative career fields might affect the students' goals and perceptions of their mathematics abilities. Teachers' nontraditional attitudes about female employment opportunities can also have a positive influence on females' mathematics classroom participation. The authors also pointed out that teachers tend to treat males and females differently, often to the detriment of girls' mathematics achievement.

Professional development training at the university level and at the high school level is necessary to inform future teachers and current teachers about the hidden cultural biases that may have crept into their teaching philosophy and techniques which give male students an advantage over the female students. Along with continuing education about gender equity there needs to be some assessment of gender equity attitudes that would highlight any differences that might exist in the classroom.

Research Assumptions

The following assumptions were considered to be important in this study:

1. It was being assumed that the responses received on the Sex-role Egalitarian Scale and the demographic section of the instrument would be the actual attitudes and characteristics of the respondents.

2. There is a negative gender bias toward females in secondary mathematics classrooms.
3. Knowledge about future career opportunities for students helps teachers be more effective in their career counseling with students.
4. Video training about nontraditional jobs for females is one of the most effective media with which to train teachers in future career opportunities for their students.
5. There are more career opportunities in mathematics and science for males than there are for females.
6. Companies are interested in hiring females in the mathematics and science fields.
7. Teachers are not overtly gender biased toward males or females, but are interested in both genders progressing and being successful in their classrooms.
8. Gender bias can be determined by administering the SRES Employment Roles domain, consisting of 19 questions.
9. Gender equity video training for secondary mathematics teachers can help them achieve a gender-neutral approach to teaching mathematics.
10. Mathematics teachers may unwittingly give more attention to males than females.
11. Mathematics teachers may feel that males will be more likely to use mathematics in future career paths.
12. Mathematics teachers who treat their female students in an unfair manner may be doing so unconsciously and with no real malice (Scott, 2000, p. 8).
13. Mathematics teachers may be expressing their traditional attitudes about females' mathematics abilities and the male's traditional career placement in the workforce.

14. Mathematics teachers may not realize that the attitudes they portray may affect female students in a negative way (Sadker & Sadker, 1994, p. 44).

15. Gender bias exists to some degree throughout the educational system.

16. Women have made gains in equal rights for females in the educational system and in the workplace during the last 20 years.

17. Professional development training for mathematics teachers is important in helping teachers fulfill the role of teachers as career guidance counselors.

18. Equity strategies help teachers be more equitable and effective in their student interaction.

19. Job opportunity awareness training helps teachers to be sensitive to opportunities for females in nontraditional jobs.

20. Gender equity professional development training for mathematics teachers helps them see how gender-role stereotyping, bias, and discrimination limit career choices, opportunity, and achievement for both sexes (Burke, 1993).

21. Career education is developmental (Bailey & Stadt, 1973, p. 69), and career guidance should be a part of the total school curriculum in addition to stand-alone career exploration classes.

22. Career education should encourage students to see the relevance of school subjects (Gitterman et al., 1993) as they relate to their future career choices.

23. If a student is relatively sure about his or her future career choice, this realization adds more impetus and importance to related subjects.

24. The traditional perception of society is that boys will choose careers in engineering, science, and technology (Bailey & Stadt, 1973, p. 113).
25. Males and females perform and participate equally in mathematics prior to adolescence, but females exhibit less confidence than males in their mathematical ability in high school.
25. Males are more likely than females to choose higher mathematics courses and careers requiring strong mathematics backgrounds.
26. Males perform better than females on the mathematics sections of national achievement tests.
28. Stereotyping of careers for females by teachers and parents affects girls' perception of mathematics in future career decisions.
29. Teachers' perceptions and beliefs can affect students' career goals and their selection of advanced mathematics or science courses.
30. Teachers' nontraditional attitudes about female employment opportunities can have a positive influence on females' mathematics classroom participation.
31. Teachers and administrators shape the gender equity climate of schools by being positive or negative role models for gender equity.

Purpose of the Study

The purpose of this research is to determine whether or not secondary mathematics teachers' sex-role egalitarian attitudes toward traditional employment of females can be improved by viewing a 20-minute video training program about nontraditional jobs for females.

The Problem of the Study

Secondary mathematics teachers' attitudes about traditional gender-role employment may produce a negative gender bias towards females. Gender bias is evident throughout most school settings (Sadker & Sadker, 1994), and it can produce differences in the way that females and males are treated. If teachers are not aware of current nontraditional opportunities for females, the counseling that girls receive from teachers may be biased and short-sighted. Females make as good or better grades in mathematics (Huang et al., 2000, p. 48) and should be encouraged to pursue higher-paying careers that require a background in mathematics. According to Huang et al., women are enrolling in postsecondary science and engineering programs in half the number that males are enrolling (p. 59). The current employee pool must include more females and minorities if the United States is to remain competitive in the global market (CCAWMSETD, 2000, p. 4).

Hypotheses

The null hypotheses that are tested in this study are the following:

H₀1: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video.

H₀2: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace* and the secondary

mathematics teachers who did not view the video when categorized by gender.

H₀3: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by age.

H₀4: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by ethnicity.

H₀5: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by years of teaching experience.

Limitations

The results and conclusions of this study can be generalized only to the secondary mathematics teachers employed by the Fort Worth Independent School District.

Delimitations

This study was limited to secondary high school mathematics teachers in the Fort Worth Independent School District (FWISD) employed in the spring of 2001. Gender bias is evident throughout most school settings, but this research has chosen to concentrate on gender bias in the mathematics classroom as it relates to the sex-egalitarian attitude of mathematics teachers. There are many different types of media and curricula to use in gender equity professional development training. A decision was made by this researcher to use a 20-minute training video designed to encourage females to choose nontraditional careers that require a strong background in mathematics.

Definition of Terms

Attitude -- A relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner.

Career paths -- Career choices that lead student in prescribed courses that will prepare them for occupations in careers requiring a strong mathematics background.

Employment roles -- Societal beliefs about the equality or inequality of males and females regarding issues related to paid employment.

Gender bias -- Perceptions toward each sex based on preconceived ideas and expectations about how males and females should look, act, and respond.

Gender discrimination -- The act of treating individuals in a differential manner because of their sex.

Gender equity -- The term used to describe the concept of both sexes being treated equally or in a similar manner without bias.

Nontraditional jobs -- Jobs held by women that are masculine in nature and normally would be held by men and those jobs held by men that are feminine in nature and normally would be held by women.

Occupational exploration -- A stand-alone ninth-grade exploratory class that examines possible career options, job requirements, and salaries.

Secondary high school mathematics teachers - Secondary mathematics teachers who teach one or more mathematics classes in the Fort Worth Independent School District.

Sex-role -- “A constellation of qualities an individual understands to characterize males and females in his or her culture” (Block, 1973, p. 512).

Sex-role stereotyping -- Actions or perceptions that cause males and females to be channeled into interests, activities, and goals considered “appropriate” for their particular sex.

SRES -- Sex-role Egalitarianism Scale, developed by King and King, which measures traditional sex-role attitudes of the respondents.

Title IX -- The legislation passed by Congress in 1972 that provided for equal treatment in the participation and the benefits of any education program receiving federal financial assistance (Higher Education Act, 1972).

Traditional jobs -- The jobs that society perceives to be masculine in nature that normally would be held by men and those jobs of a feminine nature that normally would be held by women.

Traditional sex-role attitudes -- “Attitudes which are based on polar, dichotomous conceptions of the nature and roles of men versus women (Osmond & Martin, 1975, p. 745).

Sex-role egalitarianism -- An attitude that causes one to respond to another individual independently of the other individual’s sex and does not discriminate against or relate differentially to another on the basis of the other’s sex (Beere, King, Beere, & King, 1984, p. 564; King, Beere, King, & Beere, 1981, p. 3).

Summary

The purpose of this study is to determine the effect on secondary mathematics teachers’ sex-role egalitarian attitude after receiving a video training program about nontraditional jobs for females. The study should be of significance to educators, administrators, students, parents, government leaders, and the business community, because sex-egalitarian attitudes are important in encouraging females in deciding to follow science, engineering, and technology careers. Females are needed in the technical jobs of the future to assure that the United States will be able to maintain its global competitiveness. The employment of more female workers in the SET fields will require recruitment of females for enrollment in higher mathematics courses. Secondary mathematics teachers who are encouraged to assist their students in making nontraditional career choices will be an important part of the solution to closing the

gender gap in science, engineering, and technology employment. Gender bias has a negative effect on people and situations, even if it is an unconscious act. Awareness about gender equity and how it can be obtained in the classroom and in society should be a high priority for all education and business stakeholders. The attainment of an equal education for students in a gender-equal atmosphere should be the goal of every educational professional. Continual professional development concerning gender equity can help obtain and retain an egalitarian atmosphere in the educational process.

Chapter 2 is an overview of the issues and studies relating to gender role egalitarianism. The struggle for women rights and gender equity is discussed from a historical perspective. The changing job roles of females are examined and related to the current deficit of females employed in the SET fields. Chapter 3 presents the methods and procedures to be used in acquiring, collecting, and analyzing the data for this study. Presentation of the data and the findings is included in chapter 4 and the summary, conclusions, and recommendations are discussed in chapter 5.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Tevye, the main character of the popular Broadway musical *Fiddler on the Roof*, emerges from the shadows as the house lights come up, and he bellows out a song about “tradition,” the theme of the musical. Tradition is at the heart of gender bias and this research study, the purpose of which is to measure the traditional and nontraditional attitudes of secondary mathematics teachers about jobs for males and females. Gender bias has its roots in tradition, which makes it as old as history and as current as today.

Women’s Struggle for Equal Rights

The history of women’s struggle for equal rights goes back hundreds of years, but a change toward women in the workplace became a major issue after World Wars I and II (Arnot, David, & Weiner, 1999). The large number of men who went to war produced a shortage of workers in both England and the United States. Women were recruited to fill jobs traditionally held by men. The shortage of male workers in the United States and England is mirrored by a struggle for women’s equal rights in both countries. The shortage of mechanical workers in both the United States and England who built planes and warships produced a need for women to fill the ensuing employment gap. Employers found that women could do many of the jobs that men did, and in some cases, they did them better. Although England seemed to maintain a more conservative attitude than the United States, the English legislators were caught in a bind. The English had laws on the books preventing women who were married with children from holding

certain jobs, because the conservative political legislators had a traditional view of a woman's responsibility to her family. According to Arnot et al., men were supposed to work, and women were supposed to stay home, have children, and be intimately involved in raising their children. In the United States, the attitude of the Congress was similar to its counterpart in England, but no laws had been passed to keep married women with children out of the workforce. With the need for nurses, metal workers, electricians, and teachers, the laws in England were revamped. Married women were now wage earners who were very much involved in all aspects of society and who became an important part of the political makeup, with a significant number of both single and married females making up the workforce.

As married and single women in the United States and England became entrenched in the workplace, education became an important element in a woman's world. If women were going to be in the job market in large numbers, they needed to be trained. The old vocational tracks of home economics and teacher preparation for females only highlighted the inequality that existed in the educational setting. Emphasis on males as the breadwinners existed for years until a shift in employment occurred. By 1998 women made up over 46% of the workforce (Bureau of Labor Statistics, 1998), as shown below in Figure 1.

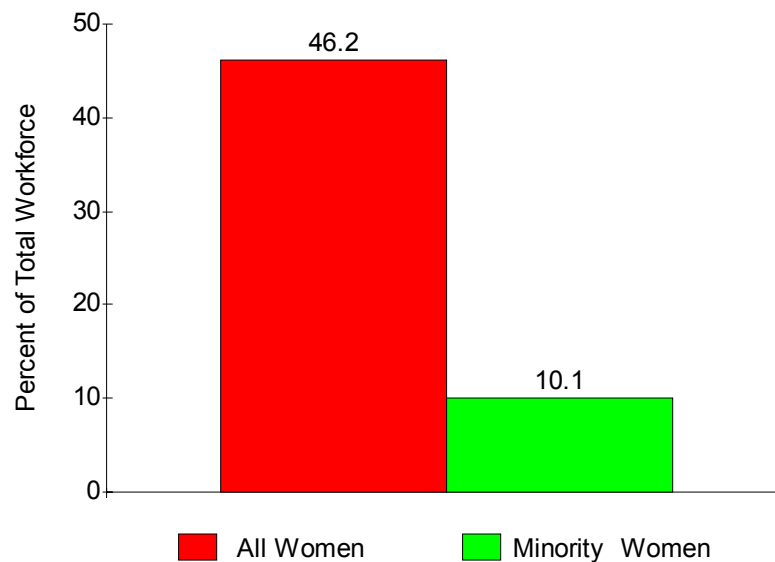


Figure 1. Women in the workforce. From BLS (1998).

Women's rights supporters became unhappy with females receiving an education that prepared them for only a "motherly" or "nurturing" role and did not give them the opportunity to compete with men in all areas of the workplace (Sadker & Sadker, 1994, p. 120). Women had proven during wartime that they could perform jobs traditionally held by men.

During the 1950s and 1960s, the feminist movement began to take hold in the United States and in England. In London, Margert Thatcher, an intelligent, conservative, and effective professional, ran for political office and held her own in the political realm. She became a legislator by defeating a male opponent. While she was holding office in the legislature, she became the mother of twins. From a traditional perspective, she should have remained at home to take care of her children, but instead, she returned to her political appointment and in time became the prime minister of England. She became

a role model and a champion of women who wanted to stay in the workforce after they have children (Arnot et al., 1999).

Women's Rights Legislation

As the feminist movement progressed in the U. S., pressure was put on legislators to pass laws prohibiting gender discrimination. One of the bills passed by the U. S. Congress that addressed the problem of gender discrimination was the passage of Title IX of the Higher Education Act of 1972 (HEA). As the feminist movement brought attention to the gender discrimination issues in the workplace, school administrators, teachers, and people interested in public education gave much thought to and wrote extensively about the problem. The legislators began to respond to the desires of their constituents by presenting various bills that dealt with gender bias to be brought to committee and eventually to the congressional floor. Title IX was one such proposal that received enough attention and respect that the act was finally agreed on in 1972. The act stated that “no person in the United States shall on the basis of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program activity receiving federal financial assistance” (HEA, 1972). With millions of dollars of federal assistance at stake, the public education entities from grade school to universities began to scrutinize their programs under the watchful eye of the U. S. Department of Education. It is interesting to note that, after 28 years, the federal government, as late as 1991, had never penalized any school by depriving them of funds (Hansot, 1993, p. 20; Sadker & Sadker, 1994, p. 36). Yet the gains that have been realized for women under this legislation have been robust.

The most obvious forms of gender bias that prompted this legislation occurred in the field of athletics. Many universities and secondary schools failed to provide equal opportunities for females to participate in sports activities, and the female programs received less money from the budgets than did the male programs (Sadker & Sadker, 1994, p. 126). Universities and secondary schools began to fund and provide equal opportunities in basketball, track, swimming, volleyball, softball, and other sports. This meant that a quantifiable amount of budget dollars had to be spread over almost twice the number of students. It became impossible to fund all the various men's sports programs, so many of the men's teams were eliminated or severely curtailed. Many swimming, track, and wrestling programs were dropped because of the lack of funds. The results have been a more favorable and balanced approach to funding female sports activities at both the university and the secondary levels since the passage and implementations of the Title IX legislation. The National Advisory Council on Women's Educational Programs, in their report to Congress in 1992, stated that Title IX led to significant improvement in opportunities for women and girls in athletics and other educational activities (p. 126).

As more educational research was being done, the attention of the U. S. Congress was directed to gender bias that was believed to exist throughout the educational system. By 1976, Congress had passed another law concerning gender bias in education. The idea of sex discrimination or gender bias became an important topic. The Educational Amendments Act of 1976 (EA) passed Congress and provided more safeguards for fair treatment of women (EA, 1976). This legislation included an emphasis on overcoming

sex discrimination and sex stereotyping in education and in vocational education specifically (EA, 1976). The act provided federal grants to assist states

to develop and carry out such programs of vocational education within each state so as to overcome sex-discrimination and sex stereotyping in vocational education programs (including programs of homemaking), and thereby furnish equal educational opportunities in vocational education to persons of both sexes. (p.16)

This act also provided for a full-time person in each state who would coordinate and direct the vocational education programs that were specifically designed to reduce sex stereotyping that could lead to gender bias in vocational counseling and course selection (EA, 1976). The new position was designed to create greater awareness of programs and activities with the purpose of reducing gender bias in job preparation and employment. By gathering, analyzing, and disseminating data about the existence of gender bias, an effort was made to correct the problems and deficiencies that caused inequity in the treatment of females. Attention was given to monitoring and examining all personnel laws prohibiting sex discrimination. Through the recommendations submitted to the local education agencies and other interested institutions and bodies, this awareness would be an asset to local communities in overcoming sex stereotyping and gender bias (EA, 1976).

Gender Bias Controversy

With the passage of time, gender bias awareness has increased and has been reduced, especially in the educational setting; however, females are still

underrepresented in traditional job categories such as engineering and science. Many blame the education system for not preparing and informing female students of the opportunities and challenges in the SET fields. Although females are underrepresented in many career fields, critics of gender bias are not convinced that it is a major issue. Therefore, battles over gender bias remain. Some people believe that gender bias in education is not as serious as some researchers have represented it. Accusations have been made that researchers and organizations have skewed the research on gender bias toward females in order to promote the political purposes of the feminist movement (Leo, 1999).

David and Myra Sadker have conducted many studies since 1980 about gender bias in education. Their research has included critical statements about teachers who portray gender bias attitudes. The Sadkers' opinions are supported and promoted by many critics who call for and desire to see gender equity in the classroom and in society at large. One professional, however, feels that the Sadkers' research has been inappropriately interpreted by some feminist groups to make a political point (Leo, 1999). Judith Kleinfeld, professor of psychology at the University of Alaska-Fairbanks, pointed out in her analysis of the AAUW's study, *Expectations and Aspirations: Gender Roles and Self-Esteem* (1990), that

59 percent of the girls and 57 percent of the boys said they were called on often, and more than the other gender. Sixty-seven percent of the boys and only 63 percent of the girls said they were not allowed to say things they wanted to say.

Apparently embarrassed by the political incorrectness of its own study, the AAUW released it with no publicity (as cited in Leo, 1999, p. 24).

Leo (1999) has drawn attention to what he believes is a misrepresentation of the research done in the area of gender bias:

After seven years, the truth is finally beginning to catch up with “How the Schools Shortchange Girls,” the influential but largely false 1992 report by the American Association of University Women. The report, which swept through the world of education and led to girls-only financial plums of the Gender Equity in Education Act, described the American classroom as a hellhole for girls.

Female students were allegedly invisible, ignored, silenced, and broken by a loss of self-esteem. (p. 24)

The tenor of Leo’s (1999) article indicated a battle between those who disagree with the findings of various feminist organizations that have a vested interest in exposing gender bias. The preconceived positions of the researchers and the proponents who interpreted them were suspected by Leo of skewing the results to strengthen their positions. He raised a question about the research and which gender was being abused. Although, according to Leo, “females lagged behind males in mathematics and science test scores,” he pointed out that males were much farther behind females in writing skills (p. 24). He also noted that women have surged past men in college attendance (55% female, 45% male) in recent years and have been making gains in the number of positions in various professions such as law and accounting. According to Leo, “By

1994, women attained almost half of professional degrees, up from almost none in 1961”

(p. 24). Leo concluded with this argument:

Our schools have many flaws, but the oppression of females isn't one of them.

The educational status of boys, not girls, is the real problem. Boys as a group, particularly minority boys, are falling behind, getting lower grades, suffering more emotional difficulties, getting punished far more frequently, dropping out more often, and reading and writing at levels that are appalling by girls'

standards. (p. 24)

Women have made extraordinary gains in most employment areas, but females still only represent 15% of the employed engineers and scientists, yet females made up over 50% of the workforce (BLS, 1998).

Underrepresentation of Women in SET Fields

The discrepancy in the employment of men and women in the mathematics and science fields and in the number of advanced science classes taken indicates a problem that must be solved if the United States is to remain competitive in the global market (CCAWMSETD, 2000, p. 3). Men are enrolled in larger numbers than females in mathematics and science classes, although females often receive better grades than males in those classes.

In September 2000, CCAWMSETD published a final report called *Land of Plenty* based on a 1-year study.

The Honorable Constance A. Morella, a member of the U.S. House of Representatives from Maryland, developed and sponsored legislation creating the

Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development. The U.S. Congress mandated a commission to analyze and describe the current status of women, underrepresented minorities, and persons with disabilities in the science, engineering, and technology pipeline, beginning in early education classrooms and progressing through the SET pipeline to professional life in industry, government, and academe. Additionally, the Commission was instructed to develop and insure recommendations regarding the recruitment, retention, and advancement of women, underrepresented minorities and persons with disabilities in SET education and careers. (CCAWMSETD, 2000, p. 4)

Elaine M. Mendoza, chairperson for the study, opened the executive summary with the following statement: “As we enter the twenty-first century, U.S. jobs are growing most rapidly in areas that require knowledge and skills stemming from a strong grasp of science, engineering, and technology” (CCAWMSETD, 2000, p. 10). The SET career fields all require a strong background in mathematics. There are a number of women and minorities who are at different transition points in the mathematics and science employment pipeline. At the transition from high school to college, a large percentage of highly capable underrepresented minority students are forced out of the pipeline because of a lack of high-quality science and mathematics preparation in high school. Because of negative social pressure about females working as scientists and engineers, and because of lack of encouragement (coupled with active discouragement), women are diverted from interest in SET majors. (CCAWMSETD, 2000, p. 12)

The executive summary for the CCAWMSETD report closes with this warning: “If, on the other hand, the U.S. continues failing to prepare citizens from all population groups for participation in the new, technology-driven economy, our nation will risk losing its economic and intellectual preeminence” (CCAWMSETD, 2000, p. 5).

In 1997 women constituted 22.8% of the science and engineering labor force, those either employed or seeking work.

Table 1

Percentage of women scientists and engineers in the workforce

	1993	1995	1997
Total scientist and engineers	22.5	22.4	22.8
Computer-mathematics	30.7	28.9	27.3
Life and related scientists	34.3	34.9	36.2
Physical and related scientists	21.5	21.6	21.9
Social and related scientists	50.5	48.9	52.1
Engineers	8.6	8.6	9.1

Note. In *Women, minorities, and persons with disabilities in science and engineering*:

2000. NSF: Division of Science Resources Studies, 1997, chap. 5.

The term *scientists and engineers*

includes all people who were employed in a science and engineering and non-science and –engine/ering occupation and who have ever received a bachelor’s degree or higher in a science or engineering field, plus those people holding a non-science and –engineering bachelor’s or higher degree who were employed in a science or engineering occupation. (NSF, 1997, p. 50)

Women's Selection of Nontraditional Careers

In their report on *Entry and Persistence of Women and Minorities in College Science and Engineering Education* by the National Science Foundation, Huang et al. (2000) analyzed *the National Educational Longitudinal Study of 1988*. The data showed that female high school students are much less likely to select science and engineering majors than are males. In the executive summary of their National Center for Education report, Huang et al. wrote that successful females in science and engineering programs showed strong family support as one indicator of success. This finding suggests that, although women are less likely than men to enter science and engineering fields, those women who do enter science and engineering fields are likely to do well. Further, among students enrolled in 4-year science and engineering programs in the 1st year of college, women tend to have strong family support, high expectation, healthy self-confidence, and solid academic preparation (p. ix). A contrasting statistic to these data is that women in recent years have been growing into a majority in overall postsecondary education (NSF, 1997). With a majority of females entering and completing college, why are more females not choosing to pursue careers in the SET fields?

In her foreword to the pamphlet *Counselor and Bias-Free Career Planning Programs: Preparing Students for Improved Decision Making*, B. Hinkle (1993) stated that

skilled trades and technologies are usually referred to as non-traditional occupations for women, while service, clerical, health, and sales jobs are usually considered as non-traditional for men. Occupations with a prevalence of men

generally are higher paying jobs and require more education than traditionally female occupations. Non-traditional occupations are broad and varied, offering a range of options suitable to the diversity of women's needs. Since new technologies are radically changing the labor market, it is imperative for women to consider non-traditional careers for their own economic survival. Many non-traditional jobs offer higher salaries, better benefits, and better advancement opportunities. (p. ii)

The choosing of a career while one is in high school is extremely important, especially in careers requiring a strong mathematics background. Secondary mathematics teachers are in a position to encourage students to pursue careers in the SET fields. A sex-role egalitarian attitude is a vital requirement for mathematics teachers if females, who are needed in the SET fields, are to be encouraged to consider careers that require a strong mathematics background. If higher mathematics classes are not chosen in high school, students are unlikely to enroll in SET courses in college.

The purpose of this study is to determine whether or not a 20-minute video presentation on nontraditional career opportunities for females can change the attitude of mathematics teachers about stereotyped perceptions for females in mathematics-related career opportunities. An activity such as a short video program is a starting point in helping secondary mathematics teachers embrace a sex-egalitarian attitude that could encourage their female students to consider nontraditional careers in the SET fields. The short video program used in this study could easily be expanded to include various gender-equity classroom strategies for use in future professional development training.

Chipman et al. (1985) pointed out that long-range programs are more effective in changing attitudes than are short-range programs.

Melissa Keyes, in her research project done in 1992, referred to a study by Granberry in 1980 that examined the effects of racism and sexism awareness. A staff development program funded by Title IV on the professional staff of a southeastern Michigan school district was used for Granberry's research efforts. This study compared the effects of a long-term and short-term program on attitudes of the same groups. "The results indicated that the short-term training caused no change in attitudes; evaluation of the long-term training showed 'significant' change" (Keyes, 1992).

Gender Bias in the Classroom

With the evident disagreement about the emphasis on and existence of gender bias in the secondary mathematics and science classrooms, there is a need for research that encourages gender equity in all educational areas. Mathematics and science classes are critically important because mathematics is a prerequisite for science and engineering classes.

Many educators have been concerned about the equitable treatment of males and females in the classroom (Houston, 1996, p.75), among them, Bradley Scott, the senior education associate who directs the Intercultural Development Research Association's (IDRA) South Central Collaborative for Equity and Professional Development. Scott (2000) has stated that the attitude of many educators is

often clouded by their inability to see how their interactions with others may be filtered through negative attitudes, prejudices lack of information, ignorance,

and/or benign non-awareness. Actions that flow from such positions may also appear to be insensitive and disrespectful even when no such intention exists. (p. 11)

In the same publication, Scott (2000) recommended that “in school districts and on campuses, assessments or surveys be conducted to determine people’s attitudes, perceptions, expectations and prejudices...and that training for justice and equality occur for staff, students, and parents” (p. 8).

The professional development of mathematics teachers that emphasizes the importance of the role of teachers in career guidance could help teachers be more equitable and effective in student interaction. Huang et al. (2000) believe that “teachers and counselors may influence students’ choices among college programs. Women were influenced by high school teachers or guidance counselors in making college plans” (p.14).

A.G. Watts, outlined three aspects of career education: (a) self-awareness, (b) opportunity awareness, and (c) decision and transition learning. In illustrating the three areas that Watts identified, Burke (1993) pointed out that, in the area of opportunity awareness, one of the outcomes that need to be implemented is to “describe how sex-role stereotyping, bias, and discrimination limit career choices, opportunity and achievement.” (as cited in Gitterman, 1995, p. 2). Whatever bias exists in the classrooms is probably happening as a subconscious activity without any malice on the part of the teachers (Scott, 2000, p. 8).

The attitude of mathematics teachers may favor males due to a traditional sex-role attitude that perceives men as scientists and women as homemakers, teachers, or nurses. Secondary mathematics teachers may feel that since males go on to careers that will require mathematics proficiency, they set higher standards and demand a greater effort from the males than the females, perpetrating learned helplessness (Sadker & Sadker, 1994). Regardless of the causes for gender bias, most educators think that gender bias is an unwanted and undesired occurrence.

Nontraditional Job-Roles Intervention

Davis and Humphreys (1985) outlined five intervention programs: (a) short-term interventions, including 1-day career conferences, workshops, science fairs, or speakers; (b) printed and audiovisual products and exhibits; (c) experiential learning, including internships and field placements; (d) long-term efforts involving courses and curricula, retraining programs, and support programs; (e) teacher education programs, including in-service and summer institutes to modify teacher attitudes and increase their skills.

This research project used professional development training for secondary mathematics teachers as a short-term experimental intervention of an introductory nature. The video was not perceived as training that would produce a large change in the participants' gender equity attitude, but it was hoped that the video training would impact the gender equity attitudes of the mathematics teachers in a discernable manner. The topic of the video is actually the intervention per se, and the video is only the media

by which the role model concept is presented. The video shows interviews with seven individual women who are employed in nontraditional jobs.

Since this research was an investigation concerning the attitudes of secondary mathematics teachers as they relate to traditional sex-role perception, which might result in sex- stereotyping, a training video about nontraditional jobs for females seemed appropriate. A traditional attitude about the types of jobs that females might chose could influence secondary mathematics teachers to think that mathematics training may hold more significance for males than for females. Some secondary mathematics teachers may put more emphasis on seeing males master the essential elements to a greater degree than females because of the future careers they believe the two genders might choose.

Mathematics teachers may not be aware that females are welcomed and wanted in the engineering, science, and other fields that require a strong mathematics background. An increase in awareness of the opportunities available for females in mathematics and science may improve the sex-role egalitarian attitudes of secondary mathematics teachers.

Because employment of women in the science, engineering, and technology field has been basically stagnated for the past 20 years (NSF, 1997), there is an urgent need to recruit females into technical and professional employment. Intervention programs, using a training program for secondary mathematics teachers that inform them of the career opportunities for females in the SET fields, could tip the employment scale toward a more gender-neutral position. Making secondary mathematics teachers aware of nontraditional career opportunities is an important step in the encouragement of female

students to continue their enrollment in science, mathematics, and technology courses (CCAWMSETD, 2000, p. 14). This would be an important step in closing the gender gap in mathematics-related careers.

Review of Training Video

The video used in this research project is *Women in the Workplace*, distributed by Enter Here L.L.C. It is a high school educational 20-minute video program featuring interesting and diverse women as role models for respect, perseverance, independence, and constructive cooperation in the world of work. The video was released in 1997 by Enter Here L.L.C. The company is located in Evanston, Illinois. The company offers a companion video, *Men in the Workplace*, that addresses nontraditional jobs for males (Enter Here L.L.C., 1996).

The video in this project features women working in nontraditional jobs who serve as role models for female students. The seven women interviewed were employed as a soil conversation technician; a land surveying crew chief; a contract movie, TV, and commercial production assistant; an aquaculture technician; a banking supervisor of a data- collection department; a postmaster of a large city; and a police officer working in a local community. Most of the women interviewed emphasized the need for a solid mathematics, science, and technology background. Although the video is addressed to students, teachers' understanding and attitude could be affected through exposure to females working in nontraditional jobs. The purpose of this study is to learn whether secondary mathematics teachers' gender equity attitudes are positively influenced by a 20-minute video about nontraditional jobs for females. Nineteen sex-equity questions

make up the Employment Roles domain of the Sex-Role Egalitarianism Scale (SRES) Form K version, which was used to measure any change in the sex-role egalitarian attitude of the teachers. The experimental group that viewed the video was compared to a control group who did not see the video.

Review of Sex-Role Attitudes Instrument

Measurement of sex-role attitudes has been the subject of many research projects over the past 50 years. These projects produced a number of attitude measurements, such as the Beere Egalitarianism Measure (BEM), the Attitudes Towards Women Scale (AWS), and the SRES. After a review of the different instruments available to measure sex-role attitudes, the SRES was determined to be the best indicator for measurement. The Sex-Role Egalitarianism Scale was published in 1993 and has been used in numerous research studies. The internal consistency coefficient alpha for the employment domains is .89. The coefficient alpha for all items is .97. Validity was well-established using construct validation, and the instrument has been cross-validated with the BEM and ATW attitude measurement instruments.

Two Central Michigan University professors designed the SRES in 1993. They received their doctoral degrees from the University of Washington, Department of Educational Psychology and Measurement Program. In addition to their work on the measurement of gender-role attitudes, they have studied work-related attitudes (King & King, 1993).

The explanation of the SRES and its psychometric properties focuses on the validity of the construct that the instrument seeks to measure rather than the validity of the test itself (King & King, 1993).

We purposefully avoid wherever possible, talking about the test's content validity, the test's concurrent validity, and so on, preferring instead to view accumulated SRES-related findings as evidence of the viability of the sex-role egalitarianism construct. Moreover, the general framework of the last two chapters is intended to reflect the four components or stages of the construct validation process. (p. 17)

In researching gender-role attitudes, King and King (1993) became convinced that the central issue of bi-directional equality or egalitarianism had not been adequately addressed. The result of their research produced “an instrument based upon a construct that reflected not solely judgments of women in traditional/non-traditional role behaviors but also men in traditional/non-traditional role behaviors” (p.3). The full instrument is composed of five domains: (a) Marital Roles, (b) Parental Roles, (c) Employment Roles (d) Social-Interpersonal-Heterosexual Roles, and (e) Educational Roles. Because this research pertains mainly to the employment of females in nontraditional jobs, this researcher determined that the other domains were not specifically relevant to the issues at hand. Permission was received from Sigma Systems, Inc., the publisher of the instrument, to use only the 19 items related to Employment Roles. The items in the Employment Roles domain address beliefs about men and women in their workplace roles.

The response format for each item on the SRES is a 5-point Likert-type scale, ranging from *strongly agree* to *strongly disagree*. Item scores are assigned such that a score of 5 represents the most egalitarian position and a score of 1 represents the least egalitarian position. Domain scores are obtained by summing across each subset of 19 items. According to the SRES manual,

The SRES should prove useful to researchers who seek a mechanism to monitor, understand, or predict the antecedents, consequences, and correlates of gender-role attitudes. In particular, researchers interested in studying gender-based stereotyping and discrimination as these relate, for example, to educational, career, or job opportunities, might find the instrument appropriate. (King & King, 1993, p.4)

The manual also suggests that the SRES could play a role in program evaluation, where sex-role attitude change is an expected outcome of some social intervention. The authors also suggested that the SRES might serve as an appropriate assessment tool in staff development and training programs within the workplace. Results from the SRES could help employees recognize the subtleties of bias and prejudice both within themselves and in the behaviors of others (King & King, 1993).

An explanation of the psychometric properties of the SRES is presented in chapter 3, which addresses the procedures and methods of the research. In chapter 4, the data retrieved from the assessment are tabulated and analyzed. Chapter 5 includes the summary, conclusions, and recommendations resulting from the analysis of the data.

CHAPTER 3

METHODS AND PROCEDURES

This research study has focused on the sex-role attitudes of secondary mathematics teachers, with an emphasis on the employment of females in nontraditional jobs. The methods and procedures used in this study are presented in a clear and concise manner in order that any future duplicate study may be carried out with the same purpose, methods, and procedures as the original study. Replication as a validity tool was emphasized by Ohlund and Yu (2000): “Experiments really need replication and cross-validation at various times and conditions before the results can be theoretically interpreted with confidence” (p. 1). The purpose of this research study is to measure secondary mathematics teachers’ sex-role egalitarian attitudes towards female employment. The design of the study, a quasi-experimental project, includes the selection of three random groups in the place of random selection procedures. The design of the study, the description of the research subjects, the validity and reliability of the assessment instrument, and the statistical methods used in the analysis of the data collected are discussed in the following paragraphs.

Design of the Study

This study utilized a quasi-experimental design, which used three random groups. Two of the groups were combined to form a control group, and the remaining group was the experimental group. A posttest-only control group design was chosen for the ability to control most of the threats to validity not provided by other designs (Campbell &

Stanley, 1963). This is a two-group design, in which one group is exposed to a treatment while a control group is not exposed to the treatment. Both groups are to receive the same assessment, at the same time. The test results were analyzed with appropriate statistical procedures in order to determine the effects of treatment. This design was selected because of the protection it offers to the internal and external threats to validity as outlined by Campbell and Stanley (1963, p. 116). The paradigm for the Posttest-Only Control Group design is:

$$R \quad X \rightarrow O1$$

$$R \quad \rightarrow O2$$

The interpretation of the design is: R equals random selection of the groups; X is the treatment; O1 is the experimental group assessment; and O2 is the assessment of the control group (Campbell & Stanley, 1963; Ohlund & Yu, 2000). This design is similar to the Solomon four-group design, which is probably the most powerful experimental approach and is, in essence, a duplication of the last two groups of the Solomon four-group design. The use of this experimental design requires that data be analyzed by the use of an appropriate statistical procedure (Leedy, 1997, p. 232). It is a design that can be used in situations in which the population cannot be pretested or in situations in which a random selection will produce an equal representation from the same population.

According to Ohlund and Yu (2000),

the Posttest-Only Control Group design controls for testing as main effect and interaction, but unlike the Solomon four-group, it does not measure them. But the

measurement of these effects is not necessary to the central question of whether or not X (the intervention) did have an effect. (p. 8)

The posttest-only control group design controls for all of the threats to validity provided by the Solomon four-group design, which is recognized as the preferred experimental design by most researchers.

By using a random selection by groups of the subjects to be assessed, the need to pretest the two groups was eliminated. The validity threat of selection was controlled by randomization. In this project, a random selection of the subjects is impossible to obtain. The three groups of secondary mathematics teachers were composed according to the mathematics courses the teachers were teaching. The groups were assigned randomly because the two smaller group members was more nearly equal the largest group. The largest group was chosen as the experimental group to receive the video training treatment because they were meeting in a small auditorium conducive to a video presentation. The posttest-only control group design also controls for the test-retest threat to validity. Because the respondents are representatives of the same extreme pool and make up the total universe of subjects to be assessed, the characteristics of the respondents in the control group and the experimental group should contain all of the attitudes and characteristics of the universe to be assessed. The random assignment of the groups controls for the validity threat of regression to the mean, which results from the inclusion of extreme scores or characteristics (Ohlund & Yu, 2000). The mortality and history threat to the validity of this study was nullified by simultaneous administration of the measurement instrument to all those subjects who were present at the professional

development training session for secondary mathematics teachers. The training session held by the FWISD on March 2, 2001, included virtually all the secondary mathematics teachers employed by the FWISD.

Assessment Administration

The SRES Employment Role domain (the dependent variable) was administered to the control group and the experimental group after the experimental group viewed the training video *Women in the Workplace* (the independent variable). It was expected that the mean scores of the SRES results would reveal statistically significant improvement for the experimental group rather than the control group who did not view the training video.

Research Hypotheses

The primary research question was analyzed by testing a null hypothesis using a one-way ANOVA. The hypothesis will be rejected or not rejected using the .05 level of significance, that provides a 95% probability that the statistical result is true and not a result of chance. The null hypotheses for this study are:

H₀₁: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video.

The null hypothesis and the alternative hypothesis equations for H₀₁ of this study are:

$$H_{01}: u_1 - u_2 = 0$$

$$H_{01a}: u_1 \neq u_2$$

H₀₂: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace* and the secondary mathematics teachers who did not view the video when categorized by gender.

H₀₃: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by age.

H₀₄: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by ethnicity.

H₀₅: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by years of teaching experience.

Description of Research Subjects

The secondary mathematics teachers employed by the Fort Worth Independent School District who attend the professional development training on March 2, 2001, were used as the subjects for this research project. One-hundred forty-six secondary mathematics teachers attended the meeting. Fifty-four of the mathematics teachers saw a training video about nontraditional jobs for females and were administered a posttest. The remaining mathematics teachers received the posttest only. The total universe of secondary mathematics teachers was given a sex-role attitude assessment, the Employment Role domain of the SRES. The FWISD mathematics teachers are varied in their gender, age, ethnicity, and years of teaching experience. No effort was made to assess the mathematics teachers who did not attend the mandatory professional development meeting, which included only those who were sick or had received prior permission to miss the training.

Demographics

A general description of the subjects was gathered from the answer sheets of the instrument. At the top of the answer sheet, the respondents marked their gender, age, ethnicity, and years of teaching experience. These data are summarized in chapter 4 and used in the summary and conclusion in chapter 5.

Random Group Assignment Procedures

Upon consultation with the administrators in charge of the training session for the FWISD mathematics department, the mathematics teachers who were to be teaching Algebra 1 from a traditional perspective were chosen as the experimental group. The

traditional Algebra 1 teachers met in a small auditorium, which made the showing of the video more convenient. The two remaining groups made up the control group. They met in regular high school class rooms. The two groups used as the control group consisted of mathematics teachers who were teaching Algebra 1 using a new computer program method and those mathematics teachers who were teaching mathematics classes other than algebra, such as geometry, Algebra 2, trigonometry, and other higher mathematics classes. The experimental group viewed the training video *Women in the Workplace* and then received the Employment Role questions of the SRES assessment. The control group did not view the training video and received only the assessment.

Sex-Role Egalitarianism Instrument

The Sex-role Egalitarianism Scale (SRES) developed by King and King (1993) was used to determine the sex-role attitudes of the respondents. The instrument measures five areas: (a) Marital Roles, (b) Parental Roles, (c) Employment Roles, (d) Social-interpersonal-heterosexual Roles, and (e) Educational Roles. The instrument provides a profile sheet for scoring that produces a total score by which the attitudes of the respondents are evaluated. The SRES, published by Sigma Assessment Systems, Inc., located in Port Huron, Michigan, is included in *Buros Mental Measurements Yearbook*.

The scale was developed to measure attitudes toward the equality of men and women. The long test includes two 95-question forms (B and K) and two 25-question abbreviated forms (BB and KK). Both instruments have been tested for validity and reliability, and the short forms have been correlated with the long forms for reliability. The SRES is a self-report instrument that the authors suggested as useful to researchers

who may want to study gender-based stereotyping and discrimination as they relate to educational, career, or job opportunities (King & King, 1993).

Because of the relevance of the Employment Roles domain to the subject of nontraditional jobs for females, this researcher chose to assess only the 19 items in the Employment Roles domain instead of all 95 questions in the long K Form. Permission was requested from the test publishers, Sigma Assessment Systems, Inc., to reproduce the 19 items from Form K of the SRES for use in this research, and permission was granted. The SRES has also been identified as a useful tool in evaluating programs where sex-role attitude change is an outcome goal of intervention (King & King, 1993).

The respondents recorded responses on a Likert-type scale, ranging from *strongly agree* to *strongly disagree*. One point is given for a *strongly disagree* response, and 5 points are given for a *strongly agree* response. A *disagree* response is awarded 2 points and an *agree* response is awarded 4 points. A *neutral* response is given 3 points. The score for each item is totaled, with a high score reflecting a nontraditional sex-role egalitarian attitude and a low score indicating a traditional sex-role egalitarian attitude. A traditional sex-role egalitarian attitude would indicate a biased attitude about female employment in nontraditional jobs, and a nontraditional sex-role egalitarian attitude would indicate a gender-neutral attitude toward female employment in nontraditional jobs. Respondents are asked to circle the choice that best describes their own personal opinions (King & King, 1993, p. 9). The instrument is scored by hand, and directions are printed on the revised testing form. A sample copy is included in Appendix E of this study.

The SRES Form B and K have an internal consistency coefficient alpha for consistency reliability of .97 (King & King, 1993, p. 89). The internal consistency coefficient alpha for the Employment Roles domain used in this research is .89 (p. 89). The Employment Roles domain pertains to beliefs about the equality or inequality of males and females regarding issues related to paid employment (p. 19).

Test-retest reliability (3-4 week interval) was .88 and .91 for Forms B and K, respectively. There is no evidence in support of predictive validity. Several studies have confirmed a correlation of the SRES with instruments that measure egalitarian sex-role attitudes. The Attitudes Toward Women Scale (AWS) was found to have a correlation of .86 in a study of predominantly female college students.

Collection of Data

The mathematics director in charge of the training meeting introduced the researcher to each group and explained to the teachers that a research project would be performed during the training session on a voluntary basis. The meeting was turned over to the researcher who handed out a letter to all the attendees that explained the purpose and goals of the research project. A copy of the letter is included in Appendix C. The research volunteers were informed that they were assisting in a doctoral research project that would measure the attitudes of secondary mathematics teachers about nontraditional jobs for females and that all information collected would be anonymous and confidential. There were no teachers who did not wish to participate in the self-report assessment.

Directions were read aloud, and the volunteer aspect of the program was emphasized, along with the anonymity of the data collected.

The researcher met with the experimental group and introduced the video *Women in the Workplace*. The viewers were encouraged to watch for instances where mathematics or mathematics tools were used in the nontraditional jobs held by the females being interviewed.

After the experimental group viewed the video, they received a copy of the SRES self-report assessment and an instruction sheet, both of which are included in the Appendixes D and E respectively.

The SRES Employment Roles Domain instrument was administered to the two groups designated as the control group by the researcher. A copy of the SRES assessment and an instruction sheet was distributed to both groups. The instructions were read aloud by the researcher. The respondents were encouraged to give their personal response and not the response that might be expected from them by other people or entities.

In addition to answering the 19 questions, the participants were asked to complete the information at the top of the answer sheet that included information about the respondents' gender, age, ethnicity, number of years of teaching experience, and whether or not they had viewed the training video. The respondents were instructed not to put their names on the assessment so that confidentiality could be maintained. The completion time allotted for completion of the survey was 15-minutes. The completed assessment and demographic data were collected by the researcher and scored by hand.

Analysis of Data

The scores of the control group and the experimental group were tallied to arrive at a grand mean for both groups. The means (u_1 and u_2) were analyzed using a one-way ANOVA. The independent variable was the control group and the experimental group. The alpha or significance level was set at .05. Four demographic characteristics were collected: (a) gender, (b) age, (c) ethnicity, and (d) years of teaching experience. These data are summarized and presented in chapter 4 to provide insight into the make-up of the population used for the research and the possible recommendations for future studies given in chapter 5.

The statistical tests were performed using the software package of the *Statistical Package for the Social Sciences*. The demographic information was analyzed to determine if there was any significant interaction between the levels of the independent variable when categorized by demographics that would provide helpful information in determining future professional development training strategies.

The demographic and descriptive data are analyzed and presented in chapter 4 with tables to assist in making the summary and conclusion in chapter 5. The last item to be addressed is to identify possible recommendations for further study.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this study was to determine if a training video could be effective in improving the sex-egalitarian attitude of secondary mathematics teachers. *Women in the Workplace*, a 20-minute video about females in nontraditional jobs that require a strong background in mathematics, was selected for the treatment to be used as the independent variable in this research study. A total of 146 Ft. Worth Independent School District (FWISD) secondary mathematics teachers was used as the research subjects. The dependent variable was the Employment Role domain questions on the SRES-Form K that measured the mathematics teachers' sex-egalitarian attitudes. The higher scores on the assessment indicate a greater amount of sex-egalitarian attitude that can also be stated as less of a gender-biased attitude toward females concerning nontraditional jobs for females (King & King, 1983).

The analysis of data will be presented in the order of the hypotheses as stated in chapter one of this study. The null hypotheses provide the framework for the analysis of the data collected. The *Statistical Package for the Social Sciences* was used to perform the statistical operations.

Analysis of Collected Data

The analysis of the data collected from the Fort Worth Independent School District mathematics teachers was used for the purpose of rejecting or failing to reject the five null hypotheses proposed in chapter 1. The data were analyzed using generally accepted statistical procedures and methods. A discussion of the methods of statistical analysis follows the presentation of each hypothesis.

H₀₁: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video.

To analyze the differences between the mean scores of the 92 teachers in the control group and the 54 teachers in the experimental group on the SRES Employment Role domain questions, a one-way ANOVA was used. The independent variable in the one-way ANOVA was the video treatment administered to the experimental group. The means used in the one-way ANOVA are summarized below in Table 2 and the results of the ANOVA are summarized in Table 3.

The mean in Table 2 for the control group that did not view the video is 75.46 (SD = 11.33). The mean for the experimental group that viewed the video was 74.93 (SD = 9.33). The two groups were very close to being equal, with only a small difference of .53. The statistics for the one-way ANOVA in Table 3 indicate that there was no significant difference between the control group and the experimental group, $F(1, 144) = .088, p = .767$. Therefore, the null for H₀₁ was not rejected.

Table 2

Summary of means for the one-way ANOVA by group

Group	Gender	Mean	SD	N
Control Group		75.46	11.33	89
Experimental Group		74.93	9.93	54
Total		75.26	10.79	143

Table 3

Summary of one-way ANOVA by group

	Sum of Squares	df	Mean Square	F	Sig.
Between groups	10.381	1	10.381	.088	.767
Within groups	16942.660	144	117.657		

As a matter of interest for future training topics and procedures, data for (a) gender (b) age (c) ethnicity, and (d) years of teaching experience were collected. Each of the demographic categories was tested with a separate hypothesis. The results of the two-way ANOVAs that were applied to the data for the demographics are presented below along with a discussion of the statistical analysis.

H₀₂: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by gender.

Table 4 below summarizes the mean scores of the males and females used in the two-way ANOVA that is summarized in Table 5. The mean for the female scores in Table 4 is 77.51 (SD = 9.54) and the mean for the male scores is 71.77 (SD = 11.49), which produced a 5.94 difference in the means. The calculated F value in Table 5 indicates that there was no significant difference in the interaction between groups and gender, $F(1, 139) = .804, p = .372$. A further analysis of the data in Table 5 indicates a significant difference in the main effect for gender, $F(1, 139) = 10.924, p = .001$. Therefore, the null for H_{02} was rejected. The computed eta squared indicates the effect size was a medium size according to Cohen of .073. The effect size for the main effect of gender is an estimate of the extent to which the groups differ in the population on the dependent variable (Cohen, 1977).

Table 4

Summary of means by gender

Gender	Mean	SD	N
Female	77.51	9.74	87
Male	71.77	11.49	56
Total	75.26	10.79	143

Table 5

Summary of 2-way ANOVA – Group by gender

Source	Sum of Sq.	df	Mean Square	F	Sig.
Between	1215.349	3	405.116	3.676	.014
Group	17.092	1	17.092	.155	.694
Gender	1203.994	1	1203.994	10.924	.001
Group*Gender	88.560	1	88.173	.804	.372
Error	15320.078	139	110.216		
Corrected Total	16535.427	142			

H₀₃: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by age.

The teachers were divided into two age generations. One generation was younger, identified by under 50 years of age, and the other generation was older, identified by over 50 years of age. This division was based on industry standards that “describe an older worker as anyone over 50 years of age (Paul & Townsend, 1993)”. A two-way ANOVA was used to test the significance of difference in the group means. The two independent variables for this analysis were groups and generation (under 50 years of age for younger generation and over 50 years of age for older generation). Table 6 is a summary of the means that were used to perform the two-way ANOVA that is summarized in Table 7. An analysis of the data in Table 7 indicates that there was no

significant interaction, $F(1, 139) = .058$, $p = .810$ and no significant main effect between generations, $F(1, 139) = .026$, $p = .873$. Therefore, H_03 was not rejected.

Table 6

Summary of means by generation

Gender	Mean	SD	N
Female	77.51	9.74	87
Male	71.77	11.49	56
Total	75.26	10.79	143

Table 7

Summary for 2-Way ANOVA – Group by generation

Source	Sum of Sq.	df	Mean Square	F	Sig.
Corrected model	19.135	3	6.378	.054	.983
Group	17.471	1	17.471	.148	.701
Generation	3.034	1	3.034	.026	.873
Group*Generation	6.844	1	6.844	.058	.810
Error	16384.110	139	117.871		
Total	826940.000	143			
Corrected Total	16403.245	142			

H_04 : There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by ethnicity.

There were three ethnic groups, consisting of 94 white teachers, 28 African-American teachers, and 16 Hispanic teachers. The mean for each group is presented in

Table 8. A two-way ANOVA was used to determine if there was a significant difference between the mean scores of the three ethnic groups that is presented in Table 9. The results indicate that there was no significant interaction, $F(2, 138) = .055$, $p = .947$ and there was no significant difference in the main effect between the three ethnic groups, $F(2, 138) = 1.226$, $p = .297$. Therefore, the null H_0 concerning ethnicity was not rejected.

Table 8

Summary of means by ethnicity

	Mean Attitude Scores			
	White	African Am.	Hispanic	Total
Number in group	94	28	16	138
Control group	75.45	74.07	79.06	75.32
Experimental group	74.35	73.00	79.29	74.70

Table 9

Summary for 2-way ANOVA – Group by ethnicity

Source	Sum of Sq.	df	Mean Square	F	Sig.
Between	325.289	5	65.058	.551	.737
Group	14.874	1	14.874	.126	.723
Ethnicity	289.451	2	144.726	1.226	.297
Group*Ethnicity	12.928	2	6.464	.055	.947
Error	15578.682	132	118.020		
Corrected Total	15903.971	137			

H_0 5: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the

video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by years of teaching experience.

Table 10 below summarizes the means for five different teaching experience groups. The first two groups were separated by 5 years teaching experience and the remaining three groups were separated by 10 years teaching experience. These categories were selected in order to make the number of subjects in each group more similar in number and at the same time, use the conventional break of 5 year and 10 year intervals. The last experience group included teachers with more than 31 years of teaching experience. There were only three teachers with more than 40 years of teaching experience at 41, 44, and 45 years of teaching experience.

The data in Table 10 shows less experienced teachers (0-5 years of teaching experience) in the experimental group that viewed the video with less bias (76.24) than the control group (0-5 years of teaching experience) that did not see the video (74.83). In the second category (6-10 years of teaching experience), the control group showed less bias (76.26) than the experimental group (72.00). It is not likely that the treatment made the experimental group more biased, but it is more likely that the two groups were not equal in some characteristic due to chance.

The third category (11-20 years of teaching experience) reveals that the experimental group was less biased (75.42) than the control group (72.67). The last group (31-40+ years of teaching experience) had means in the control group (77.00) that reveals less bias than the experimental group (72.00). Again, one possible explanation is that the groups were not equal in characteristics due to chance.

Table 10

Summary of means for years of teaching experience

	Years of Teaching Experience					Total
	0-5	6-10	11-20	21-30	31-40+	
Number in group	46	31	24	9	36	146
Control group mean scores	74.83	76.26	72.67	74.25	77.00	75.48
Experimental mean scores	76.24	72.00	75.42	81.00	72.00	74.93

Table 11 is a summary of the ANOVA results that compared the different groups of mathematics teachers when categorized by years of teaching experience. There was no significant interaction, $F(4, 136) = .934, p = .447$, between groups and teaching experience and no significant main effect for groups by years of teaching experience, $F(4, 136) = .254, p = .907$. Therefore, the null H_0 was not rejected.

In the unpublished doctoral thesis, *Preservice teacher preparation and leadership for gender equity*, the author cited a 1989 research study by M. Jones that reported no difference between more experienced teachers (21-35 years of teaching experience) and less experienced teachers (0-3 years of teaching experience) in regards to their stereotypic gender attitudes (Pryor, p. 60). The finding of this report is similar to M. Jones research findings mentioned above.

Table 11

Summary for 2-way ANOVA – Group by years of teaching experience

Source	Sum of Sq.	df	MS	F	Sig.
Between	587.827	9	65.314	.543	.841
Group	2.687	1	2.687	.022	.881
Teaching Exp	122.107	4	30.527	.254	.907
Group*Teaching Exp	449.335	4	112.334	.934	.447
Error	16365.214	136	120.332		
Corrected Total	16180.230	145			

Summary of Findings

The null H_{01} was not rejected because there was no significant difference in the control group and the experimental group at the .05 level of confidence. The null H_{02} was rejected because there was a significant difference between the male and female scores at the .05 level of confidence. The null H_{03} was not rejected because there was no significant difference in the control group and the experimental group at the .05 level of confidence when categorized by age generations (over 50 years of age and under 50 years of age). The null H_{04} was not rejected because there was no significant difference in the control group and the experimental group when categorized by ethnicity at the .05 level of confidence. The null H_{05} was not rejected because there was no significant difference in the control group and the experimental group when compared by years of teaching experience groups at the .05 level of confidence. The demographic variable of gender was the only category that revealed a significant variation in sex-role egalitarian attitudes.

In the following chapter, there is a discussion of the possible reasons for the differences in the various scores and the implications that they may hold for future professional development training and future research on gender bias. Inferences and observations regarding the analyses are explained from the viewpoint of this researcher and recommendations are outlined for future studies.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine if a 20-minute training video about nontraditional jobs for females could produce a positive improvement in the sex-egalitarian attitudes of the secondary mathematics teachers in the Ft. Worth Independent School District (FWISD). The training environment for the research was the professional development in-service training day held by the FWISD on March 2, 2001. All of the secondary mathematics teachers attending the training agreed to participate in this research project. There were 87 identified females and 56 identified males that participated in the 19-question SRES Employment Role domain assessment. The review of the literature revealed that the subject of gender equity attracted the attention of many people and groups over the last 40 years. The AAUW (1992a) report on *How schools shortchange girls* concluded that tests, curricula, textbooks, and teacher behavior are some of the important areas that can produce a limitation on the opportunities for females in receiving an equal education free of gender bias. Special Congressional Commissions concluded that the United States, as a whole, has not reached its potential in productivity because of gender inequities (CCAWMSETD, 2000, p. 1). Although there has been an improvement in gender equity issues over the past 40 years, both in industry and in education, there is still one area of industry that has not shown improvement in the hiring practices. The area of science, engineering, and technology is still lacking anything close to equal employment for males and females. The percentage

of females to male employees in the science, engineering, and technology field is still around 22% while the employment of females in the workforce is 50% or more.

The problem addressed by this research project involves secondary mathematics teachers' attitudes about traditional gender-role employment. A negative gender bias towards females, evident in some school settings as documented by Sadker and Sadker (1994), can produce differences in the way that females and males are treated in the classroom. A basic underlying assumption about the problem addressed in this study is that teachers need to be aware of current nontraditional opportunities for females. A video about nontraditional jobs for females was chosen as the training tool to help inform teachers about the nontraditional jobs available to females today. The video is the independent variable and the SRES assessment is the dependent variable for this study. The SRES assessment was used to measure the egalitarian attitude of the secondary mathematics teachers. A high score on the assessment translates to more of an egalitarian attitude and a low score signifies less of an egalitarian attitude.

Summary of Null Hypotheses

There was no significant finding on four of the five hypotheses tested in regards to the training effect, but a significant result was found in the comparison of the scores of males and females at the probability level of .05.

H₀1: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video.

This hypothesis was designed to test the effectiveness of the training video in improving the sex-egalitarian attitude of the secondary mathematics teachers of the FWISD. An ANOVA was applied to the data in order to analyze the means and determine if the video treatment was successful in changing the participant's attitudes about gender equity. A significant difference was not found in the mean scores; therefore, this null hypothesis was not rejected.

H₀2: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace* and the secondary mathematics teachers who did not view the video when categorized by gender.

The second hypothesis was designed to investigate one of the four demographic characteristics gathered from the data. This is the only hypothesis that was significant of the five hypotheses tested. The ANOVA results indicated a significant result with a critical value of .001. This finding agrees with other research and a general attitude that females are more sex-egalitarian than males. Because the calculated *F* value exceeded the .05 level of confidence when the means were categorized by gender, this null hypothesis was rejected and considered significant.

H₀3: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary

mathematics teachers who did not view the video when categorized by age.

The concept of older and younger workers was analyzed to see if there was a difference in the sex-egalitarian attitude of those under 50 years of age and those over 50 years of age. It is a general perception that in our culture younger people are more egalitarian than older people who have grown up in a gender biased society. The results of the ANOVA applied to the data indicate that there was no significant difference between the mean attitude scores recorded for the two age generation groups of secondary mathematics teachers. Therefore, this null hypothesis was not rejected.

H₀4: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary mathematics teachers who did not view the video when categorized by ethnicity.

The hypothesis categorized by ethnicity was designed to determine if there was a difference between ethnicity and sex-egalitarian attitudes. All of the mean scores were within a small margin of difference for each ethnic group and the ANOVA results indicated that there was not a significant difference between the ethnic groups. Therefore, this null hypothesis was not rejected.

H₀5: There are no significant differences between the mean attitude scores of secondary mathematics teachers on the Employment Roles domain of the SRES who viewed the video, *Women in the Workplace*, and the secondary

mathematics teachers who did not view the video when categorized by years of teaching experience.

The last hypothesis was designed to determine if the years of teaching experience affected the sex-egalitarian attitudes of the mathematics teachers. It could be speculated that the longer one teaches, the more gender equal they become or the reverse results could also be supported. The ANOVA results for this hypothesis indicates that there is no difference between the teachers with more experience and the teachers with less experience in their sex-egalitarian attitudes. This finding is in agreement with the finding on the age demographic. The teaching experience category and the age category are correlated and therefore, they should produce a similar result, which they did. This null hypothesis was not rejected because the calculated value of F exceeded the F value in the statistical table at the .05 level of confidence.

Conclusions

The following conclusions were determined to be relevant to the findings of this study.

1. The most significant finding of this study was in the result of gender equity.

The statistics from the data indicate that the female teachers of the FWISD are less gender biased than their male counterparts. This is in line with research findings and is an important fact for the mathematics administrators to know. It could affect the type of continuing education that is provided to correct the deficit in gender equity among their mathematics teachers. The significant results found in the statistical analysis showing more gender equity by females than males is in line with other gender equity studies

(Pryor, 1996). The significant finding showing that female mathematics teachers had better gender equity mean scores than male mathematics teachers gives weight to the validity of this study, because the conclusions about gender equity are similar to the results of other gender equity studies.

2. The 20-minute training video about nontraditional jobs for females was not effective in producing an attitude change in secondary mathematics teachers' sex-egalitarian attitudes. The content of the training video, which is an interview with seven females who have jobs considered to be nontraditional that require a strong background in mathematics, is classified as a role model presentation. Other content for the training video may have produced different results, but the use of the video as a medium of presentation was chosen because of the brevity, the use of visual and auditory effects, the ability to bring information from a distant source with pictures, and the ability of other researches to duplicate the research project in a precise manner. The brevity was a necessary consideration because of the time constraints of 45 minutes provided by the training administrators for the treatment and the assessment. It was an assumption of this research that a professionally produced video presentation of the interviews provided the opportunity to show interviews that might not otherwise have been available in a live presentation. The scope, appeal to multiple senses, music, and the ability to show the actual job performance of the interviewees was considered to be far superior to any local interviewees that might have been obtained in the Ft. Worth area. The video provided a convenient, effective, and viewer-friendly presentation that made the choice of the video-cassette medium the best type of presentation for this research project. Research

has shown that it takes an intense and prolonged treatment to change people's attitudes, but the use of a short introductory topic is helpful in setting the stage for future training sessions and emphasis (Keyes, 1992, p. 22). The difference in the mean scores of the control group and the experimental group, revealed a very small difference of only .53 in the mean score of the two groups. The control groups mean score was larger than the experimental group that viewed the video, but the differences were probably due to the random chance makeup of the two groups. The two groups' scores were very close to being equal, which confirms that the intervention of the video training program using interviews of role models was ineffective. In the unpublished dissertation *Measuring Changes in Educator Attitudes As a Result of Technical Assistance in Sex Equity*, by M. A Keyes (Keyes, 1992), one question in the ten question instrument was used to address the issue of role models as a type of intervention. The role model questions was, 'I think it is important for students to see a wide variety of role models in the schools.' The research included 22 workshop sessions and involved 649 participants. The mean score on the pretest was the lowest of all ten questions and next to the lowest mean score on the posttest by only .024. This fact could indicate that an intervention using role models as the content emphasis might not be the most effective topic to use in a training video about gender equity issues where the purpose is to change the attitudes of secondary mathematics teachers.

3. The demographic of years of teaching categories shows that mathematics teachers in the FWISD are growing older, as indicated by the large number of teachers with more than 20 years of teaching experience. A total of 45 secondary mathematics

teachers have more than 20 years of teaching experience. The largest group of teaching experience was the 0-5 category at 46 teachers, but the 30-40+ category was the second largest group at 36 teachers and is 25% of all the teachers. After a teacher has taught for 30 years, many of them choose to retire. There is now a need to re-hire retired teachers who are older in order to fill the mathematics teaching vacancies. An article in the 1998 Performance Improvement Quarterly written by Allen and Hart, points out that older workers have much to offer employers, and because of employee shortages at the entry level, older workers over 50 years of age will be used to fill the employment vacancies. They state in the article, “By 2025, those who are 50 and older will make up nearly 30% of the population of the entire U.S. workforce (Caswell, 1994).” (Allen, 1998, p. 92). The demographic data for this research shows that there are 94 secondary mathematics teachers under 50 years of age and there are 46 secondary mathematics teachers over 50 years of age. The older to younger worker percentage in the FWISD is now greater than the 30% level expected by the year 2025. This information could be of value to FWISD mathematics administrators who might use the information in considering the assessment of the attitudes of future teachers, both older and younger. By being aware of this information, the administrators could determine the topics and types of continuing education needed for their mathematics teachers. Gender equity, as an in-service topic, could be used to facilitate the filling of nontraditional jobs in the SET fields with needed females.

4. The findings indicated that there was no significant difference in the attitudes of older, more experienced, and ethnically diverse mathematics teachers. Teachers’

attitudes affect the way they treat their students, and administrators need to be cognizant of the effects of gender bias on their students. Therefore, the gender bias attitude information could hold significance for the administrators in charge of hiring and training as they plan the topics, speakers, and presentation methods for training events.

5. Females make as good or better grades in mathematics (Huang et al., 2000, p. 48), and they are as qualified as males to succeed in job opportunities that require a strong background in mathematics. Females need the encouragement and support of mathematics teachers and parents to overcome the traditional culture bias that can limit females' expectations and confidence about pursuing jobs in the science, engineering, and technology fields, which provide higher-paying, prestigious careers. The SET field has a high vacancy rate in job openings and employment needs. There are not enough white males to fill the employment vacancies, and if the United States is to remain competitive in the global market, then females and minorities need to be the resources that are used to fill these SET employment vacancies. Otherwise, the jobs in the SET fields will be filled by mostly male applicants from outside the U. S., thereby limiting the opportunities for females in this country to fill the job openings and bring their unique perspective to the scientific fields.

6. A negative gender bias about females performing nontraditional jobs in the workplace could possibly affect the type of counseling that female students receive from mathematics teachers about continuing in higher mathematics classes. The higher mathematics classes are necessary to prepare for entry into such areas as science, engineering, and technology. Career information available to mathematics teachers

should include the current inclusive attitudes of industry about nontraditional jobs available to females. Employers in the SET fields are interested in hiring females, and this information needs to be a part of the professional development training of mathematics teachers. A gender egalitarian attitude enables teachers to have a balanced interest in future employment expectations for males and females concerning the importance of their mathematics subject to their future careers.

Recommendations

1. Because there is a limited amount of time available to administrators to do professional development training, it is difficult to obtain a commitment from the training planners to provide time to do gender equity training. Most educators and administrators, according to the observations of this researcher over the past few decades, are concerned that students receive an education free of gender bias, but the limited time available for professional development training usually causes the topic of gender bias to be given less attention. Other issues that are more important to their state ratings, such as the TAAS mathematics test, take precedence over gender equity topics. Therefore, this researcher recommends that administrators and trainers for public school districts present the topic of gender equity and its issues as a part of their in-service training strategy.

2. While investigating the types of mathematics programs chosen by the students at the University of North Texas and Texas Woman's University, an interesting piece of information was discovered. Both of these universities are graduating only 15 or 20 students per year with degrees in mathematics education. With a large number of

mathematics teachers in the waning years of their careers, many will soon be retiring. This will leave a void in the number of teachers qualified to teach mathematics. Since three years of mathematics are required for each student to graduate in the state of Texas, it is easy to determine that mathematics teachers are not being graduated in large enough numbers to fill the vacancies caused by retirement or burnout. Therefore, the academic community will have to face this problem and decide how to increase the number of students choosing mathematics as their teaching field. The universities and public schools from 1st grade through 12th grade in the United States need to accept the challenge of recruiting and training female and male students who can become future mathematics teachers or science, engineering, and technology workers.

3. More research with mathematics teachers throughout the state of Texas is needed in order to gather gender equity information. Research is needed to determine the type of future professional development training that is necessary to assure gender equity in the mathematics classroom. This would require a random sample procedure that would allow the research to be generalized to all secondary mathematics teachers in Texas or in a section of the state. The cooperation of the state's school districts will be necessary to complete a statewide study of gender equity in the mathematics class room to show the need for professional development training about gender equity topics for mathematics teachers.

4. A pretest and posttest design may be necessary for future study. Mathematics professional development administrators need to allow researchers to divide their teachers in a random manner and not use the groups that they have already selected to

receive for pre-planned training. The FWISD secondary-mathematics department was very cooperative in providing the time and assistance necessary to do this research. But even with a desire to be of research assistance, their interest and time was limited by the amount of training and preparation that was needed to prepare their mathematics teachers for the semester at hand. The original suggestion by this researcher to have all the mathematics teachers divided randomly to receive the training could not be accomplished. The teachers had already been assigned to three different groups for training related to the teaching of specific mathematics courses. The three groups of teachers were then randomly selected, but the make up of the groups was questionable as to its random characteristics, thus affecting the basic design of the study. This researcher contacted numerous school districts about the possibility of doing a gender equity research project during their professional development time, but the idea met with little or no interest. For effective and productive research to be done, this researcher recommends that administrators take the time to study the gender equity issues for their mathematics students in order that all their students receive a fair and equitable education. By addressing the gender equity issues of the teaching of mathematics, the administrators could provide encouragement and support to their mathematics teachers to guide more of their female students into taking higher mathematics classes.

5. A district- or state-wide survey is needed to show the number of hours of professional development training that addresses gender equity and teachers' attitudes about the employment of females in nontraditional jobs of all types. The mathematics administrator who assisted in this study could not remember any professional

development training for mathematics teachers concerning the topic of gender equity in her more than 30 years of teaching mathematics in the FWISD.

6. The conclusions of this research showed the intervention of a video training program using female role models who were interviewed about their jobs was ineffective in changing the participants' attitudes about gender equity. In addition to a video presentation about gender equity issues, different types of training techniques could be used to support the video presentation, such as a discussion by the participants of the merits of the gender equity issues and how they could be applied in their mathematics classrooms. Some other type of presentation other than a video might be considered, such as a panel of experts, role-playing, or case studies. By comparing different types of training presentations, administrators could determine what type of professional development training is the most effective teaching method for producing effective and lasting results in regards to gender equity training or other training topics.

7. Future assessments concerning gender equity issues could help FWISD administrators determine the lasting effects of any positive gender equity attitude changes measured by this research or the need for continuing gender equity emphasis in future training programs. The entire area of gender equity is a fitting subject for continual emphasis in professional development training to ensure a gender equitable and fair education for all students.

APPENDIX A
UNIVERSITY OF NOTH TEXAS INSTITUTIONAL REVIEW
BOARD APPROVAL

UNIVERSITY OF NORTH TEXAS

Office of Research Services

February 28, 2001

Don J. Delp
8085 Eagle Mtn. Circle
Ft. Worth, TX 76135

RE: Human Subjects Application No. 01-026

Dear Mr. Delp,

Your proposal titled “The Effect of Professional Development Training for Secondary Mathematics Teachers Concerning Nontraditional Employment Roles for Females” has been approved by the Institutional Review Board and is exempt from further review under 45 CFR 46.101.

Enclosed is the Consent Form with stamped IRB approval. Please copy and use this form only for your study subjects.

The UNT IRB must review any modification you make in the approved project. Federal policy 21 CFR 56.109(e) stipulates that IRB approval is for one year only.

Please contact me if you wish to make changes or need additional information.

Sincerely,

Signature of Reata Busby on Original Copy

Reata Busby
Chair - Institutional Review Board
RB:sb

P.O. Box 305250 – Denton, Texas 76203-5250 – (940) 565-3940
Fax (940) 565-4277 - TDD (800) 735-2989 – www.unt.edu

APPENDIX B

APPROVAL OF STUDY BY ORGANIZATION

FORT WORTH INDEPENDENT SCHOOL DISTRICT
RESEARCH PROJECT EVALUATION FORM

Date Submitted: 12/14/00

Dates the project is to be conducted: From 3/2/01 To 3/2/01.

Name of Applicant: Don J. Delp

Title of Project: The Effect of Professional Development Training for Secondary Mathematics Teachers Concerning Non-Traditional Employment Roles for Females.

I recommend approval of the project in accordance with the Fort Worth Independent School District Procedures for Research.

Reviewer: Paul Brinson

Signature:

Original signed by Paul Brinson

Department: Research and Evaluation

Date: 2/02/01

Please return this form to:

Director of Research and Evaluation
1000 N. University Dr. – Suite 204 SW
Ft. Worth, Texas 76010

APPENDIX C

ASSESSMENT EXPLANATION COVER LETTER

Research Information Letter

Dear Colleagues:

My name is Don J. Delp and I am an employee of the Fort Worth Independent School District (FWISD) counseling team. I am currently enrolled at the University of North Texas in the Department of Technology and Cognition, in the School of Education.

I would like your participation in a research project that involves professional development training of the secondary math teachers of the FWISD in the area of nontraditional jobs for females. This study involves the measurement of traditional attitudes about females performing non-traditional jobs in the workforce. The 9th through 12th grade math teachers will be divided into two groups in a random method. One group will view a 20-minute video, *Women in the Work P/ace*, and fill out a 19 question self-report survey, the SRES Employment Role Domain, which addresses traditional employment by gender and take approximately 10 minutes to complete.

The second group will meet with the leadership personnel of the math department and complete the same 19 question self-report survey. The survey includes four questions to be completed by the participants concerning their age, gender, ethnicity, and years of teaching experience for tabulation purposes.

This research project is a voluntary and anonymous research project. No names of the participants are to be included on the survey forms and there are no known risks associated with participation in this project.

To insure confidentiality, the scoring and tabulation of the surveys will be done by this researcher to insure confidentiality. Your voluntary participation would be appreciated, but anyone's desire not to participate will be accepted at any time and will not affect their standing with the FWISD.

This project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects (940/565-3940). If you have any questions please contact me at 817/922-6922 or the faculty sponsor, Dr. Jerry Wircenski at the University of North Texas, 940/565-3486. This research includes women and minorities and respects the nondiscriminatory policies and requirements of the FWISD and the University of North Texas.

If you are interested in the findings of this study, you may contact the FWISD Research and Evaluation Department and Math Department administrators during the fall semester.

Sincerely,
Don J. Delp, MEd., LPC
Doctoral Candidate
University of North Texas

APPROVED BY THE UNT IRB
FROM 2/28/01 to 2/27/02 Initials on Original

APPENDIX D
ASSESSMENT DIRECTIONS

SRES
Employment Roles Domain

Instructions

The following questions contain statements about men and women. After reading these instructions, read each statement and decide how much you agree or disagree with it. We are not interested in what society says, and there are no right or wrong answers. We are interested in *your personal opinion*.

Each statement has five response options, which appear on the right side of the page.

SA = strongly agree

A = agree

N = neutral (undecided or no opinion)

D = disagree

SD = strongly disagree

For each statement, circle the one option that best describes your opinion. Thus, if you disagree with a given statement, but do not strongly disagree with it, circle the “D” corresponding to that statement. If you strongly agree with the statement, circle the “SA,” and so forth. If you do not remember what the letters stand for, just turn back to this page.

Do not circle more than one response option for any given statement. If you want to change your response, erase your circle completely, then circle the new response.

Be sure to answer *every* statement.

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P.O. Box 610984
Port Huron, Michigan 48061

APPENDIX E

SRES EMPLOYMENT ROLE DOMAIN QUESTIONS

SRES

EMPLOYMENT ROLES DOMAIN

Please fill in the following demographic data.

Gender___ Age___ Ethnicity___ Years of Teaching Experience___

*Did you view the video *Women in the Workplace* today? (circle one) Yes No

CIRCLE ONE ANSWER. We are interested in your personal opinion.

The intelligent man will go further in his career than the intelligent woman?	SA	A	N	D	SD
Female secretaries are more devoted to their jobs than male secretaries.	SA	A	N	D	SD
It is more important for a woman to like her job than it is for a man?	SA	A	N	D	SD
Men and women are equally qualified for law enforcement jobs.	SA	A	N	D	SD
Women ought to have the same chances as men to be leaders at work.	SA	A	N	D	SD
Employment of women causes many problems for employers.	SA	A	N	D	SD
A male nurse cannot be as effective as a female nurse.	SA	A	N	D	SD
woman should not be President of the United States.	SA	A	N	D	SD
Female workers should receive more sick days than male workers.	SA	A	N	D	SD
Women are as willing as men to make a long-term job commitment.	SA	A	N	D	SD
Women perform equally to men in job interviews.	SA	A	N	D	SD
Women can handle job pressures as well as men.	SA	A	N	D	SD
Male managers are more valuable to a business than female managers.	SA	A	N	D	SD
Women are equal to men in their reliability on the job.	SA	A	N	D	SD
male doctor inspires more confidence than a female doctor.	SA	A	N	D	SD
Men should not work in day care jobs.	SA	A	N	D	SD
Men and women differ in the time required to get used to a new work setting.	SA	A	N	D	SD
An applicant's sex should be important in job screening.	SA	A	N	D	SD
Men and women should be paid equally for equal work.	SA	A	N	D	SD

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